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NATIONAL LIFE
FROM THE STANDPOINT OF SCIENCE

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By KARL PEARSON, F.R.S.

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FROM THE STANDPOINT OF SCIENCE

BY

KARL PEARSON, F.R.S.

PROFESSOR OF APPLIED MATHEMATICS, UNIVERSITY COLLEGE, LONDON

SECOND EDITION

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To

W. F. R. WELDON, F.R.S.,

Linacre Professor of Comparative Anatomy
in the University of Oxford.

A SLIGHT TOKEN OF GRATITUDE FOR ALL THAT
I HAVE LEARNT FROM HIM DURING THE
YEARS OF OUR FRIENDSHIP.

PREFATORY NOTE

THIS lecture was delivered in Newcastle on November 19, 1900, to the members of the Literary and Philosophical Society. At the time of writing and delivering it the South African War and its lessons were far more omnipresent in thought and feeling than, perhaps unfortunately, they are to-day. The wave of emotion which for a time roused the nation to self-consciousness has passed, scouring out very little of our stagnant back-waters in the process. It is possibly with a nation as with an individual—both feel only intensely and are only capable of vigorous self-reform in moments of unwonted stress, or of novel spiritual experience. Still, in

quieter moments it is worth while endeavouring to bring home to the thoughtful that no community of men can trust blindly to heredity to preserve their racial characters. Every nation is an agglomeration of good and bad elements, and each new generation is born from but a relatively small portion of the whole. The greatness of a nation depends on the dominant fertility of its fitter stocks, and fluctuates with the extent of this dominance. Love of ease, a mistaken sense of duty, insidious new social habits, may tamper with the preponderating fertility of the fitter and more capable racial constituents before we have realized their effects. Some only of these things can be touched by the legislator; in the aggregate they are subject alone to social feeling and to an enlightened national pride. Is it possible to arouse a consciousness in the folk that the parentage of the next generation is not a personal but a national problem?—that a nation which has

ceased to insure that its better elements have a dominant fertility has destroyed itself far more effectually than its foes could ever hope to destroy it in the battlefield?

If the reprint of this lecture, of which the first edition has been for some time exhausted, should in the least help to quicken public opinion on this all-important point, then its purpose will have been amply fulfilled. The topic is a complex and weighty one, and my address was only a hasty talk, and not a treatise providing elaborate investigation and statistical proof of its statements. Still, most of its unproved assertions are based on results which the author has elsewhere published, or for which he has unpublished statistical warranty. But he would ask his readers to take nothing on faith; he would beg them solely to realize that there is a problem of the most urgent national importance involved in the mere possibility that while modern social conditions are re-

moving the crude physical checks which the unrestrained struggle for existence places on the over-fertility of the unfit, they may at the same time be leading to a lessened relative fertility in those physically and mentally fitter stocks, from which the bulk of our leaders in all fields of activity have hitherto been drawn.

To the lecture is added an Appendix containing two recent letters to the *Times* dealing with the problem of National Deterioration. I have to acknowledge the ready consent of the *Times* management to their republication.

K. P.

NATIONAL LIFE

FROM THE STANDPOINT OF SCIENCE

In the fore-part of this year,* when I was asked to give a lecture in Newcastle, the minds of men were not inclined to be interested in the fascinating problems of pure science. The spirits of one and all, whatever their political party or their opinions on the rights or wrongs of British action in South Africa might be, were depressed in a manner probably never before experienced by those of our countrymen now living. We can, in the light of what has happened since, afford, perhaps, to admit the truth now. We had been defeated, I may even venture to

* 1900.

say badly defeated, by a social organism far less highly developed and infinitely smaller than our own. We felt like the giant bewildered, not by the strength, but by the skill and ingenuity, of our opponent. We had lost the power of foreseeing, and our soldiers the power of adapting themselves to a change of environment. We had to learn from our foe the very armament suitable to the conditions; we had to learn that guns of great calibre could be taken into the field and, what is more, withdrawn from it; we had to learn the arts of making and of taking shelter; we had to learn the existence of something which was neither cavalry nor mounted infantry; we, a nation of horse-breeders and horse-riders, had to learn the right horse for a rough country and the right manner of handling him; nay, to some troops we even issued a new rifle, and let them practically gain their first experience of it in the field. We, no doubt, felt in those days of depression that we should learn, or partially learn, all this, and perhaps more; we hoped, with a distinguished statesman, that we should 'muddle through

somehow.' We refrained, if not completely, yet fairly successfully, from making scapegoats.

But those who saw beyond the immediate national danger were filled with a more abiding sense of risk. They recognised that the struggle for existence among nations will not necessarily be settled in favour of the biggest nation, nor in favour of the best-armed nation, nor in favour of the nation with the greatest material resources. I speak not only of war, but of the more silent, but none the less intense, struggle of peace—the struggle for trade, for commercial supremacy, for new sources of food supply, for mineral wealth, and for the raw materials of manufacture. Size and armament and material prosperity, of course, all tell; hardihood, bravery, and endurance all tell too, although not so overwhelmingly as in the days of Queen Bess. But none of these alone will suffice. Here are the flesh, blood, and sinews of a nation, but to make it foremost in the struggle, to make it a homogeneous, highly-organized whole, you must have a complex nervous system, the reflex actions

of which are not merely automatic, but under the control of that classified experience which we term wisdom.

We all know how to act in our wonted circumstances, under our usual environment: our reactions are almost automatic; but given new circumstances and an unusual environment, then prompt action means foresight, training, that rapid application of the truths learned from past experience to new facts which from various standpoints in life we call ingenuity, business-habit, scientific insight, wisdom, or, even more comprehensively, *brains*. What is here said of an individual is true of a nation. The nation, however prosperous, however hardy, however big, will fail when it comes to a crisis, when it is suddenly placed in a new environment, unless it has organized brain-power controlling its nervous system right away to the smallest outlying points. Hardihood, big battalions, command of the purse, may enable us to struggle through in either peace or war so long as we have only to meet small or semi-organized opponents, but they will not avail when great nation meets great

nation; then it is the codified experience and the organized brain-power which tell in the struggle.*

It was consciousness of this lack of real insight—not in one, but in many departments of national life—which gave an abiding gloom to the depression arising from our difficulties at the commencement of the year. It was not only the need of 'somehow muddling through' this matter, but the problem of how we were to provide against graver crises in the future, which depressed many. How was the nation's own fault to be brought home to it? How could it become a more highly-organized whole, profiting to the full by such brains as our race possesses? Such thoughts as these, rather than the purely intellectual problems of science, filled my mind when your invitation to lecture in Newcastle reached me, and they led me more or less directly to try and emphasize the national value of science.

* A further great object-lesson in these truths has been since provided by the war in the Far East. But we have been slow to realize the close resemblance between the sources of our own and of the Russian failure.

From the standpoint of science there are two questions we can, or, rather, we *must*, ask. First: What, from the scientific standpoint, is the function of a nation? What part from the natural history aspect does the national organization play in the universal struggle for existence? And, secondly, What has science to tell us of the best methods of fitting the nation for its task?

To answer at all effectually the latter question, we must first consider what is the proper answer to be given to the former. I shall therefore endeavour to lay in broad outlines before you what I hold to be the scientific view of a nation, and of the relationship of nations to each other. If at the very offset my statements strike you as harsh, cold, possibly immoral, I would ask you to be patient with me to the end, when some of you may perceive that the public conscience, the moral goodness which you value so highly, is established by science on a firmer and more definite, if a narrower, foundation than you are wont to suppose.

I want you to look with me for awhile on mankind as a product of Nature, and sub-

ject to the natural influences which form its environment. I will, first, notice a point which bears upon man as upon all forms of animal life. The characters of both parents—their virtues, their vices, their capabilities, their tempers, their diseases—all devolve in due proportion upon their children. Some may say, 'Oh yes; but we know such things are inherited.' I fear that the great majority of the nation does not realize what inheritance means, or much that happens now would not be allowed to happen. Our knowledge of heredity has developed enormously in the last few years; it is no longer a vague factor of development, to be appealed to vaguely. Its intensity in a great variety of characters in a great many forms of life has been quantitatively determined, and we no longer stand even where we did ten years ago. The form of a man's head, his stature, his eye-colour, his temper, the very length of his life, the coat colour of horses and dogs, the form of the capsule of the poppy, the spine of the water-flea—these and other things are all inherited, and in approximately the same manner. Nay, if we extend the notion of

like producing like, we shall find, as I have recently done, that the same laws are probably true for the mushroom and for the forest tree; that the principle of heredity runs with certainly no weakened intensity from the lowest to the highest organisms, and from their least to their most important characters.

Now, let us try to understand exactly what this means. Of a definite child of A and B we can assert nothing with certainty, but of all the children of a definite class of parents like A and B we can assert that a definite proportion will have a definite amount of any character of A and B with a certainty as great as that of any scientific prediction whatever. I am not speaking from belief or from theory, but simply from facts, from thousands of instances recorded by my fellow-workers or myself. Here is a great principle of life, something apparently controlling all life from its simplest to its most complex forms, and yet, though we too often see its relentless effects, we go on hoping that at any rate we and our offspring shall be the exceptions to its rules. For one of us as an individual this may be true, but for the *average* of us

all, for the nation as a whole, it is an idle hope. You cannot change the leopard's spots, and you cannot change bad stock to good; you may dilute it, possibly spread it over a wider area, spoiling good stock, but until it ceases to multiply it will not cease to be. A physically and mentally well-ordered individual will arise as a variation in bad stock, or possibly may result from special nurture, but the old evils will in all probability reappear in a definite percentage of the offspring.

I know of the case of just such a good variation appearing in a certain bad stock as far back as 1680, and the offspring of which married in the early eighteenth century into a number of good stocks, several of which we can trace in the records of the religious community of which they were members for nearly 150 years. And what do we find? In each generation the same sort of proportion of cases of drunkenness, insanity, and physical breakdown arising to distress and perplex their kinsfolk.

Now, if we once realize that this law of inheritance is as inevitable as the law of

gravity, we shall cease to struggle against it. This does not mean a fatal resignation to the presence of bad stock, but a conscious attempt to modify the percentage of it in our own community and in the world at large. Let me illustrate what I mean. A showman takes a wolf and, by aid of training and nurture, a more or less judicious administration of food and whip, makes it apparently docile and friendly as a dog. But one day, when the whip is not there, it is quite possible that the wolf will turn upon its keeper, or upon somebody else. Even if it does not, its offspring will not benefit by the parental education. I don't believe that the showman's way can be a permanent success; I believe, however, that you might completely domesticate the wolf, as the dog has been domesticated, by steadily selecting the more docile members of the community through several generations, and breeding only from these, rejecting the remainder. Now, if you have once realized the force of heredity, you will see in natural selection—the choice of the physically and mentally fitter to be the parents of the next generation—a most

munificent provision for the progress of all forms of life. Nurture and education may immensely aid the social machine, but they must be repeated generation by generation; they will not in themselves reduce the tendency to the production of bad stock. Conscious or unconscious selection can alone bring that about.

What I have said about bad stock seems to me to hold for the lower races of man. How many centuries, how many thousand of years, have the Kaffir or the negro held large districts in Africa undisturbed by the white man? Yet their intertribal struggles have not yet produced a civilization in the least comparable with the Aryan. Educate and nurture them as you will, I do not believe that you will succeed in modifying the stock. History shows me one way, and one way only, in which a high state of civilization has been produced, namely, the struggle of race with race, and the survival of the physically and mentally fitter race. If you want to know whether the lower races of man can evolve a higher type, I fear the only course is to leave them to fight it out among

themselves, and even then the struggle for existence between individual and individual, between tribe and tribe, may not be supported by that physical selection due to a particular climate on which probably so much of the Aryan's success depended.

If you bring the white man into contact with the black, you too often suspend the very process of natural selection on which the evolution of a higher type depends. You get superior and inferior races living on the same soil, and that coexistence is demoralizing for both. They naturally sink into the position of master and servant, if not admittedly or covertly into that of slave-owner and slave. Frequently they intercross, and if the bad stock be raised the good is lowered. Even in the case of Eurasians, of whom I have met mentally and physically fine specimens, I have felt how much better they would have been had they been pure Asiatics or pure Europeans. Thus it comes about that when the struggle for existence between races is suspended, the solution of great problems may be unnaturally postponed; instead of the slow, stern processes of evolution, cataclysmal

solutions are prepared for the future. Such problems in suspense, it appears to me, are to be found in the negro population of the Southern States of America, in the large admixture of Indian blood in some of the South American races, but, above all, in the Kaffir factor in South Africa.

You may possibly think that I am straying from my subject, but I want to justify natural selection to you. I want you to see selection as something which renders the inexorable law of heredity a source of progress which produces the good through suffering, an infinitely greater good which far outbalances the very obvious pain and evil. Let us suppose the alternative were possible. Let us suppose we could prevent the white man, if we liked, from going to lands of which the agricultural and mineral resources are not worked to the full; then I should say a thousand times better for him that he should not go than that he should settle down and live alongside the inferior race. The only healthy alternative is that he should go and completely drive out the inferior race. That is practically what the white man has done in

North America. We sometimes forget the light that chapter of history throws on more recent experiences. Some 250 years ago there was a man who fought in our country against taxation without representation, and another man who did not mind going to prison for the sake of his religious opinions. As Englishmen we are proud of them both, but we sometimes forget that they were both considerable capitalists for their age, and started chartered companies in another continent. Well, a good deal went on in the plantations they founded, if not with their knowledge, with that at least of their servants and of their successors, which would shock us all at the present day. But I venture to say that no man calmly judging will wish either that the whites had never gone to America, or would desire that whites and Red Indians were to-day living alongside each other as negro and white in the Southern States, as Kaffir and European in South Africa, still less that they had mixed their blood as Spaniard and Indian in South America. The civilization of the white man is a civilization dependent upon free white labour, and when

that element of stability is removed it will collapse like those of Greece and Rome. I venture to assert, then, that the struggle for existence between white and red man, painful and even terrible as it was in its details, has given us a good far outbalancing its immediate evil. In place of the red man, contributing practically nothing to the work and thought of the world, we have a great nation, mistress of many arts, and able, with its youthful imagination and fresh, untrammelled impulses, to contribute much to the common stock of civilized man. Against that we have only to put the romantic sympathy for the Red Indian generated by the novels of Cooper and the poems of Longfellow, and then—see how little it weighs in the balance!

But America is but one case in which we have to mark a masterful human progress following an inter-racial struggle. The Australian nation is another case of great civilization supplanting a lower race unable to work to the full the land and its resources. Further back in history you find the same tale with almost every European nation. Sometimes when the conquering race is not too diverse

in civilization and in type of energy there is an amalgamation of races, as when Norman and Anglo-Saxon ultimately blended; at other times the inferior race is driven out before the superior, as the Celt drove out the Iberian. The struggle means suffering, intense suffering, while it is in progress; but that struggle and that suffering have been the stages by which the white man has reached his present stage of development, and they account for the fact that he no longer lives in caves and feeds on roots and nuts. This dependence of progress on the survival of the fitter race, terribly black as it may seem to some of you, gives the struggle for existence its redeeming features; it is the fiery crucible out of which comes the finer metal. You may hope for a time when the sword shall be turned into the ploughshare, when American and German and English traders shall no longer compete in the markets of the world for their raw material and for their food supply, when the white man and the dark shall share the soil between them, and each till it as he lists. But, believe me, when that day comes mankind will no longer

progress; there will be nothing to check the fertility of inferior stock; the relentless law of heredity will not be controlled and guided by natural selection. Man will stagnate; and unless he ceases to multiply, the catastrophe will come again; famine and pestilence, as we see them in the East, physical selection instead of the struggle of race against race, will do the work more relentlessly, and, to judge from India and China, far less efficiently than of old.

Let us face this question of increasing population boldly. We cannot escape it. Sooner or later it must and will make itself felt in every progressive nation; for what I have said of the struggle of race against race makes itself again felt within every community. A nation like the French can largely limit the number of its offspring, but how shall we be sure that these offspring are from the better and not from the inferior stock? If they come equally from both stocks and there be no wastage, then the nation has ceased to progress; it stagnates. I feel sure that a certain amount of wastage is almost necessary for a progressive nation; you want

definite evidence that the inferior stocks are not able to multiply at will, that a certain standard of physique and brains are needful to a man if he wishes to settle and have a family.

Mr. Francis Galton has suggested that we might progress far more rapidly than we at present do under this crude system of unconscious wastage if we turned our thoughts more consciously to the problem, if we emphasized the need of social action in this direction, and made men and women feel the importance of good parentage for the citizens of the future. But I fear our present economic and social conditions are hardly yet ripe for such a movement; the all-important question of parentage is still largely felt to be solely a matter of family, and not of national importance. Yet how anti-social such a view may be can be easily realized. From the standpoint of the nation we want to inculcate a feeling of shame in the parents of a weakling, whether it be mentally or physically unfit. We want parents to grasp that they have given birth to a new *citizen*, and that this involves, on the

one hand, a duty towards the community in respect of his breed and nurture, and a claim, on the other hand, of the parents on the State that the latter shall make the conditions of life favourable to the rearing of healthy, mentally vigorous men and women. Bear in mind that one quarter only of the married people of this country—say, a sixth to an eighth of the adult population—produce 50 per cent. of the next generation. You will then see how essential it is for the maintenance of a physically and mentally fit race that this one-sixth to one-eighth of our population should be drawn from the best and not the worst stocks. A nation that begins to tamper with its fertility may unconsciously have changed its national characteristics before two generations have passed.

France is becoming a land of Bretons because the Bretons alone have large families. And what about England? The average net size of our families has been falling for perhaps fifty years. Who will venture to assert that this decreased fertility has occurred in the inferior stocks? On the contrary, is it not the feckless and improvident who have

the largest families? The professional classes, the trading classes, the substantial and provident working classes—shortly, the capable elements of the community with a certain standard of life—have been marrying late, and have been having small families; they have been increasing their individual comfort. All this is at the expense of the nation's future. We cannot suspend the struggle for existence in any class of the community without stopping progress; we cannot recruit the nation from its inferior stocks without deteriorating our national character.

Now, what have our economic conditions in England been during the last thirty years? The accumulation of wealth has been such at one end of society that no test of brains or of physique was needful before a man multiplied his type. Death duties and the inherent tendency of folly to squander its substance were only very inefficient, very partial, checks on the endowment in perpetuity of the brainless. At the other end of society we allowed a condition of affairs to exist in which no greater discomfort could well be produced by the introduction of

additional human beings; there were always charity and the State ready to provide, more or less inefficiently, for the surplus population. There has been scarcely any check on the multiplication of inferior stock; only in the middle ranks, among the more substantial workers with the hand and the head, have men regarded the number of their offspring and made success in life's struggle to some extent a condition of their multiplication.

Now, surely this is a very dangerous state of affairs for the nation at large. A crisis may come in which we may want all the brain and all the muscle we can possibly lay our hands on, and we may find that there is a dearth of ability and a dearth of physique, because we have allowed inferior stock to multiply at the expense of the better. There are occasions when a nation wants a reserve of strong men, and when it must draw brain and muscle from classes and from forms of work wherein they are not exercised to the full. And in that day woe to the nation which has recruited itself from the weaker and not from the stronger stocks! If you

have not the means to start all your offspring in your own class, let them do the work of another; if you cannot make them into lawyers and engineers, let them be village schoolmasters and mechanics. Or, if this suggestion raise an insurmountable, if utterly false, shame, let them go to new lands even as miners, cowboys, and storekeepers; they will strengthen the nation's reserve, and this is far better than that they should never have existed at all.

I will not say that we have a dearth of ability and of physique at this time, but I will venture to assert that there has, of recent years, been a want of them in the right places, and that last year, but for the reserve of strong men in our colonies, we should have been in far greater difficulties than we were. It is not only in warfare—that is the crudest form of the modern struggle of nations—but in manufacture and in commerce that there has been a want of brains in the right place. Leadership in trade is really no more than leadership in the army open to the man of brains; in both cases it becomes a question of wealth; the endowed but brainless get the

start. Consider, again, how the led are, in many cases, not the mentally and physically best for the task: they are too often the surplus of the inferior stocks. What wonder when we put the one in competition with the brains and training of the German commercial and technical houses we meet defeat! What wonder that, when we take the other out of its environment, the leaders cannot lead, and the led fall an easy prey to sickness and disease? The regiment which has marched farthest and has marched quickest, which has suffered little from disease and fought as well as any in the Transvaal, is a volunteer regiment, drawn from that very reserve of strength in the better stocks to which I have referred.

In industry it is the same thing. We shall do no good against the American and the German by a mere multiplication of centres of technical instruction. What we want to do is to bring brains into our industry from top to bottom. Where the brains already exist, there training will work wonders; but we shall not make the product of inferior stock capable men by merely

teaching them the tricks of their trade. In one polytechnic I found lads learning how to fold cretonnes and polish mahogany; that is to say, the manufacturers had thrust the cost of apprenticeship on the public purse, perhaps to some extent lowering the price of sofas and easy-chairs to those who care about them. The object of any technical education paid for by the State or the municipality should be the exercise of brain-power, mental gymnastics in the best sense; it should treat of the science, and not the art, of a trade. Such education—education, remember, means literally a *drawing out*, not a cramming in—ought to act as a brain-stretcher, and not attempt to communicate mere trade knowledge. Where it does the latter—and in how many cases does it not, under our brand-new system of technical instruction?—then it is merely relieving the manufacturers, and possibly the purchasers, of certain goods of such part of their cost as has hitherto been paid for apprenticeship. On the other hand, when technical education acts as a brain-stretcher, then this increased efficiency tells not only on the trade occupa-

tions, but on the social and civic life of the educated; the nation is thereby strengthening the reserve of trained brains upon which it can draw in a crisis for all sorts of other functions than those of a narrow trade. Brain-stretching fosters an adaptability to new environments. This is something very different to a more complete knowledge of trade processes or to proficiency in a special handicraft. This is a form of education for which the nation may legitimately pay; it is that which is essential to it in the struggle for existence.

I am not speaking without some experience. I have been engaged for twenty years in helping to train engineers, and those of my old pupils who are now coming to the front in life are not those who stuck to facts and formulæ, and sought only for what they thought would be 'useful to them in their profession.' On the contrary, the lads who paid attention to method, who thought more of proofs than of formulæ, who accepted even the specialized branches of their training as a means of developing habits of observation rather than of collecting 'useful facts,' these

lads have developed into men who are succeeding in life. And the reason of this seems to me, when considering their individual cases, to be that they could adapt themselves to an environment more or less different from that of the existing profession; they could go beyond its processes, its formulæ and its facts, and develop new ones. Their knowledge of method and their powers of observation enabled them to supply new needs, to answer to the call when there was a demand, not for old knowledge, but for trained brains.

Here, I think, is the point where we reach the second great function of science in national life. The first function is to show us what national life means, and how the nation is a vast organism subject as much to the great forces of evolution as any other gregarious type of life. There is a struggle of race against race and of nation against nation. In the early days of that struggle it was a blind, unconscious struggle of barbaric tribes. At the present day, in the case of the civilized white man, it has become more and more the conscious, carefully directed

attempt of the nation to fit itself to a continuously changing environment. The nation has to foresee how and where the struggle will be carried on; the maintenance of national position is becoming more and more a conscious preparation for changing conditions, an insight into the needs of coming environments.

This is the second important duty of science in relation to national life. It has to develop our brain-power by providing a training in method, and by exercising our powers of cautious observation. It has to teach not only the leaders of our national life, but the people at large, to prepare for and meet the difficulties of new environments. This is the only sort of technical education the nation ought to trouble about, the teaching people to see and to think. It is not the art of a particular trade which we want to teach in the schools, but the power of observing and reasoning upon observation.

There is a most simple description of true science which is embraced in the words: *Keep your eyes open and apply common-sense.* That is the keynote to the conduct of the

geologist who has roughly sketched the history of many thousand years as he walked across the downs with you, of the engineer who rapidly reports on a new country, of the doctor who forms rapid diagnoses as he paces the hospital ward; it is trained observation applied to physical and human nature. There is a very excellent little book which many of you may have read recently, Baden Powell's 'Aids to Scouting'; it is a capital introduction to the true scientific method. The man with a scientific training *scouts* through Nature, including under nature mankind itself. You may sum up his conduct just as I think Baden Powell's booklet may be summed up —*Keep your eyes open and apply common-sense.* What we as a nation seem to want at the present time is precisely what its commander complained of our army needing in Natal—*scouting.* I take it that the success of German technical instruction is just proportional to its efficiency in producing trained scouts. We have only just started our technical schools, but I sadly fear they are not putting sufficient stress on scouting, on

teaching how to observe and how to reason on observation as distinct from a knowledge of facts, or from a training in art or handicraft. Mechanical skill, the trick of the trade, may be learnt best in the workshop; facts and formulæ may be found in books; processes followed in the foundry and the weaving-shed in a manner that can only be mimicked in the schools; but true scouting can be learnt only from the master-scout. And here arises the real value of a band of men trained to observe and reason. This is why we want scientific schools and men of science if the nation is to maintain its position.

If you turn in almost any direction, you will see this want of trained scouts. We want them in our diplomatic service to keep their hand on the pulse of other nations; we want them in new countries to tell us of new mineral and new food supplies; we want them, above all, in our trade, to tell us what to make and how and where to send it; we want them to see what competitive nations are doing, and to provide for our mercantile marine, our railways, our manufactures being

maintained at the highest state of efficiency. Shortly, we want scouting in all branches of the national service; we need men who will observe what others are doing, who will seek for new supplies, and push the nation and prepare cautiously for its advance in every way.

I will not underrate the importance of the equipment of the scout. He undoubtedly profits by technical knowledge. You cannot send a man to push trade if he have no knowledge of the language of the people he has to deal with, or an engineer to discover mineral resources without an elementary acquaintance with geology. But I insist that the trained mind is the first thing, and for scouting a fool on horseback is worth less than a wise man on foot. We are a wealthy nation, and I fear we find it easier to provide the equipment than to discover the master-scout. I have yet to learn that the physicist with palatial laboratory and elaborate and costly implements will do more for his pupils than the man with no instrument-maker behind him. The biologist with his £80 microscopes and specimens drawn from the

four quarters of the globe may teach less than the field naturalist with the hedgerow and the lens. One of the first lessons of scouting is independence of equipment, the doing of great things with small means; and magnificent equipment, the provision of elaborate instruments and highly-trained mechanicians, too often renders your man of science and his pupils helpless in a less palatial environment. We are not going to get technical education by merely paying for it. We may show wonderful buildings, dazzling equipments, a network of examinations, and a crowd of certificated examinees, but this will not insure the training the nation wants in observation and in reasoning on observation.

We must, above all, exercise the selective faculty and choose true master-scouts, giving them a free hand, and they will teach our lads to observe and think scientifically. That is the only form of technical education which will produce the scouting power the nation needs. Some may say that this is pure science, and not technical instruction at all. I am not prepared to say it is not. I don't

care a rap, and don't believe anyone with educational interests at heart does care a rap, for the facts and formulæ and results of science being crammed into all classes of the community; they may be useful enough to men of special trades and professions. But what the nation does want in order to strengthen its civil and commercial life is a great increase in its powers of observation in its knowledge of scientific method and of the nature of scientific reasoning. The rest, the greater efficiency in trade and handicraft, will follow surely enough on that. Make the man *intellectually* stronger, and he will be a better soldier, a better trader, and a better craftsman Teach the man how to scout in the first place, and then he will know for himself the sort of equipment he wants and how it is to be provided. You furnish a charger and a sword, where peradventure a pony and a hatchet are what the trained scout would select for himself. Knowledge is the equipment which the trained mind can find for itself, but the training is a thing you have got to provide for it, and the national value of science lies first in the

training it can furnish, and only in the second place in its practical results.

There has been far too much talk about the national utility of science, and too little stress laid on its educational value. 'I want my son to learn what will be useful to him in his profession in life' is the statement I have heard from one parent after another. 'I want my son to know how to observe and to think' is the expression of a desire which I have not yet come across. This is the spirit which has ruled the movement for technical education; but if this spirit is to remain dominant, it will take a great deal to get the nation out of its present ruts. What we want are trained brains, scouts in all fields, and not a knowledge of facts and processes crammed into a wider range of untrained minds.

It may be as well now to sum up my position as far as I have yet developed it. I have asked you to look upon the nation as an organized whole in continual struggle with other nations, whether by force of arms or by force of trade and economic processes. I have asked you to look upon this struggle

of either kind as a not wholly bad thing; it is the source of human progress throughout the world's history. But if a nation is to maintain its position in this struggle, it must be fully provided with trained brains in every department of national activity, from the government to the factory, and have, if possible, a *reserve of brain and physique* to fall back upon in times of national crisis. Recent events in our commercial as well as in our military experience have led some to doubt whether our supply of trained brains is sufficient, or, at any rate, whether it is available in the right place at the right moment.

Those presumably who hold that the brains are forthcoming have raised the cry of technical instruction, which is to be a remedy for our commercial difficulties. I have little doubt that when this war is finished the cry of military instruction will be raised for our army difficulties. In the latter as in the former case large sums of money will no doubt be demanded for equipment. But I have endeavoured to indicate that there are two preliminary matters to be

considered. First, are we quite certain that we have a reserve of brain power ready to be trained? We have to remember that man is subject to the universal law of inheritance, and that a dearth of capacity may arise if we recruit our society from the inferior and not the better stock. If any social opinions or class prejudices tamper with the fertility of the better stocks, then the national character will take but a few generations to be seriously modified. The pressure of population should always tend to push brains and physique into occupations where they are not a primary necessity, for in this way a reserve is formed for the times of national crisis. Such a reserve can always be formed by filling up with men of our own kith and kin the waste lands of the earth, even at the expense of an inferior race of inhabitants. Yet if we grant that our nation has a full supply of brains both in action and in reserve, it is not knowledge in the first place, but intellectual training, which is requisite. We want the master-scout to teach men to observe and reason on their observations, and the equipment of the scout, the actual know-

ledge of facts and processes, is a minor matter.

You will see that my view—and I think it may be called the scientific view of a nation—is that of an organized whole, kept up to a high pitch of internal efficiency by insuring that its numbers are substantially recruited from the better stocks, and kept up to a high pitch of external efficiency by contest, chiefly by way of war with inferior races, and with equal races by the struggle for trade-routes and for the sources of raw material and of food supply. This is the natural history view of mankind, and I do not think you can in its main features subvert it. Some of you may refuse to acknowledge it, but you cannot really study history and refuse to see its force. Some of you may realize it, and then despair of life; you may decline to admit any glory in a world where the superior race must either eject the inferior, or, mixing with it, or even living alongside it, degenerate itself. What beauty can there be when the battle is to the stronger, and the weaker must suffer in the struggle of nations and in the struggle of individual men? You may say: Let us

cease to struggle; let us leave the lands of the world to the races that cannot profit by them to the full; let us cease to compete in the markets of the world. Well, we could do it, if we were a small nation living on the produce of our own soil, and a soil so worthless that no other race envied it and sought to appropriate it. We should cease to advance; but then we should naturally give up progress as a good which comes through suffering. I say it is possible for a small rural community to stand apart from the world-contest and to stagnate, if no more powerful nation wants its possessions.

But are we such a community? Is it not a fact that the daily bread of our millions of workers depends on their having somebody to work for? that if we give up the contest for trade-routes and for free markets and for waste lands, we indirectly give up our food-supply? Is it not a fact that our strength depends on these and upon our colonies, and that our colonies have been won by the ejection of inferior races, and are maintained against equal races only by respect for the present power of our empire? If war or

competition lessen the China trade, if a bad harvest or a flood check the import of Egyptian or American cotton, it is the Lancashire operative who feels the pinch. The day when we cease to hold our own among the nations will be the day of catastrophe for our workers at home. We could return to the condition of medieval England, to the condition of Norway or Denmark, but only by a process of intense selection, reducing our millions in a manner which the imagination refuses to contemplate. Being as we are, we cannot give up the struggle, and the moment dearth of ability, the want of brains and physique in the right place, leads to serious defeat, our catastrophe will come. That is the vision which depressed thoughtful men at the beginning of this year; that is the dread which must be ever in the mind of the true statesman when he seeks, on the one hand, to curb the rash venture which may overstrain our power, and on the other hand, to maintain our right to work the unutilized resources of earth, be they in Africa or in Asia.

Struggle of race against race, and of man

against man—if this be the scientific view of life, the basis of human progress—how have human love and sympathy come to play such a great part in the world? Here, again, I think science has something to say, although the earlier interpreters of evolution rather obscured it. They painted evolution as the survival of the fittest *individual*, and spoke of his struggle against his fellows.

But this is not the only form of selection at work; it is often quite the least effective phase of the contest. Consciously or unconsciously, one type of life is fighting against a second type, and all life is struggling with its physical environment. The safety of a gregarious animal—and man is essentially such—depends upon the intensity with which the social instinct has been developed. The stability of a race depends entirely on the extent to which the social feelings have got a real hold on it. The race which allows the physically or mentally stronger Tom to make the existence of the somewhat inferior Jack impossible will never succeed when it comes into contest with a second race. Jack has no interests in common with Tom; the op-

pressed will hardly get worse terms from a new master. That is why no strong and permanent civilization can be built upon slave labour, why an inferior race doing menial labour for a superior race can give no stable community; that is why we shall never have a healthy social state in South Africa until the white man replaces the dark in the fields and in the mines, and the Kaffir is pushed back towards the equator. The nation organized for the struggle must be a *homogeneous* whole, not a mixture of superior and inferior races. For this reason every new land we colonize with white men is a source of strength; every land of coloured men we simply rule may be needful as a source of food and mineral wealth, but it is not an element of stability in our community, and must ever be regarded with grave anxiety by our statesmen.

This need for homogeneity in a nation may be pushed further. We must not have class differences and wealth differences and education differences so great within the community that we lose the sense of common interest, and feel only the pressure of the

struggle of man against man. No tribe of men can work together unless the tribal interest dominates the personal and individual interest at all points where they come into conflict. The struggle among primitive men of tribe against tribe evolved the social instinct. The tribe with the greater social feeling survived; we have to thank the struggle for existence for first making man gregarious, and then intensifying, stage by stage, the social feeling. Such is the scientific account of the origin of our social instincts; and if you come to analyze it, such is the origin of what we term morality; morality is only the developed form of the tribal habit, the custom of acting in a certain way towards our fellows, upon which the very safety of the tribe originally depended. Philosophies may be invented, the supersensuous appealed to, in order to increase the sanctions on social or moral conduct; but the natural history of morality begins with the kin-group, spreads to the tribe, to the nation, to allied races, and ultimately to inferior races and lower types of life, but ever with decreasing intensity. The demands upon the spirit of self-sacrifice which

can be made by our kin, by our countrymen, by Europeans, by Chinamen, by Negroes and by Kaffirs, by animals, may not be clearly defined; but, on the average, they admit of rough graduation, and we find in practice, whatever be our fine philosophies, that the instinct to self-sacrifice wanes as we go down in the scale.

The man who tells us that he feels to all men alike, that he has no sense of kinship, that he has no patriotic sentiment, that he loves the Kaffir as he loves his brother, is probably deceiving himself. If he is not, then all we can say is that a nation of such men, or even a nation with a large minority of such men, will not stand for many generations; it cannot survive in the struggle of the nations, it cannot be a factor in the contest upon which human progress ultimately depends. The national spirit is not a thing to be ashamed of, as the educated man seems occasionally to hold. If that spirit be the mere excrescence of the music-hall, or an ignorant assertion of superiority to the foreigner, it may be ridiculous, it may even be nationally dangerous; but if the national

spirit takes the form of a strong feeling of the importance of organizing the nation as a whole, of making its social and economic conditions such that it is able to do its work in the world and meet its fellows without hesitation in the field and in the market, then it seems to me a wholly good spirit—indeed, one of the highest forms of social, that is, moral instinct.

So far from our having too much of this spirit of patriotism, I doubt if we have anything like enough of it. We wait to improve the condition of some class of workers until they themselves cry out or even rebel against their economic condition. We do not better their state because we perceive its relation to the strength and stability of the nation as a whole. Too often it is done as the outcome of a blind class war. The coal-owners, the miners, the manufacturers, the mill-hands, the landlords, the farmers, the agricultural labourers, struggle by fair means, and occasionally by foul, against each other, and, in doing so, against the nation at large, and our statesmen as a rule look on. That was the correct attitude

from the standpoint of the old political economy. It is not the correct attitude from the standpoint of science; for science realizes that the nation is an organized whole, in continual struggle with its competitors. You cannot get a strong and effective nation if many of its stomachs are half fed and many of its brains untrained. We, as a nation, cannot survive in the struggle for existence if we allow class distinctions to permanently endow the brainless and to push them into posts of national responsibility. The true statesman has to limit the internal struggle of the community in order to make it stronger for the external struggle. We must reward ability, we must pay for brains, we must give larger advantage to physique; but we must not do this at a rate which renders the lot of the mediocre a wholly unhappy one. We must foster exceptional brains and physique for national purposes; but, however useful prize-cattle may be, they are not bred for their own sake, but as a step towards the improvement of the whole herd.

If I have put my position at all clearly, you will see how the key to it lies in the

gregarious nature of man. The older evolutionists overlooked several of the factors of the struggle for existence. They emphasized, in a way which now appears almost absurd, the struggle of individual with individual. They do not appear to have recognised that many of the characters which give man his foremost place in the animal kingdom were evoked in the struggle of tribe against tribe, of race against race, and even of man as a whole against other forms of life and against his physical environment. Like the other political economists, they thought all real progress depended upon an all-round fight within the community. They forgot that the herd exists owing to its social instincts, and that human sympathy and racial and national feelings are strong natural forces controlling individual conduct and economic theories based purely on questions of supply and demand. It is the herd, the tribe, or the nation which forms the fundamental unit in the evolution of man, and it is to the leaders of the herd, or nation, that we ought to look for conscious recognition of this fact.

If they are true statesmen, they ought not merely to advance in the direction they may be pushed by the immediate needs of one overburdened class, or by the overloud cry of another group dominant for the time being; they ought to look upon the community as an organized whole, and treat class needs and group cries from the standpoint of the efficiency of the herd at large. Their duty is to lessen, if not to suspend, the internal struggle, that the nation may be strong externally. One point only is fundamental in that suspension of the internal struggle, and this holds for man as it holds for every gregarious animal: social sympathy and State aid must not be carried so far within the community that the intellectually and physically weaker stocks multiply at the same rate as the better stocks.

The dearth of brains and the dearth of physique are the worst misfortunes that can befall a nation, and yet how many of our rulers realize that brains and physique are not things scattered at random among the population, which they can lay their hands on whenever they need them? Our legislators get

wonderfully excited over laws relating to horses and cattle; they devote money and time to breeding purposes, and realize the strength of the laws of inheritance when they endow national studs and give prizes to encourage the maintenance of good stock, or when again they work for the establishment of selected herds. But which of them has considered domestic legislation from the natural history standpoint? What statesman has remembered that in the character of the nationl fertility of to-day is written the strength or weakness of the nation to-morrow? I fear we leave these things to chance, or to the caprice of individual selfishness. As long as the social conditions were such that the weak within the community were not protected by the State; as long as there was no restriction on the fertility of the better stocks, we might in a rough-and-ready manner trust that our population would be recruited from its fitter members. But with the social movements of the present day, the reduction in infantile mortality, principally of the inferior stocks, the reduction in the birth-rate, principally of the superior

stocks, science may well call the attention of our rulers to a possible famine—a day when we shall want brains and want physique, and shall not find the necessary reserve of them.

Take the case of ability in particular. Francis Galton has shown us that it largely arises from special stocks ; but if those stocks decrease their output, then by so much does the rare chance of a man of marked ability appearing grow rarer. Again, I repeat, we may, after all, only want brains in the right place. But besides the need of them in South Africa, which was recently fairly manifest, look to any branch of national life, and may we not fear the dearth has already begun? Where are the young men in the political world who can stir even a small section of the community to united action? Where are the younger civil servants to replace our dying proconsuls, the men to whom the nation can commit with a feeling of security and confidence the future problems of South Africa itself? Where are the new writers to whom the nation listens as it did to Carlyle, Ruskin, and Browning? or for whose books it eagerly waits as it did for those

of Thackeray and George Eliot? Where are the leaders of science who will make the epoch that Darwin and Huxley made in biology, or Faraday and Clerk Maxwell in physics? There may be steady average ability, but where is the fire of genius, the spirit of enthusiasm, which creates the leader of men either in thought or action? Alas! it is difficult to see any light on the horizon predicting the dawn of an intellectual renaissance, or heralding social and political reforms such as carried the nation through the difficult fifty years of the middle of last century. Possibly our strong men may have got into the wrong places. Ability may have drifted onto the Stock Exchange, the race-course, or the cricket-field, for aught I can say to the contrary; but I must confess to feeling sometimes that an actual dearth is upon us. And if this should be so, then the unchangeable law of heredity shows us only too clearly the chief source of the evil: we have multiplied from the inferior, and not from the superior stocks.

I have laid special stress on this point, for I want to impress you with two aspects under

which science is of national value. The one is as a great factor of education. On its facts and its formulæ I lay no weight; you will find them appraised—nay, overvalued—by the modern apostles of technical instruction. But education is not a communication of knowledge; it is a drawing out and an exercising of brain power. Here science—true science, in the hands of the master-scout—can teach us to observe and infer from observation more readily and more effectively than perhaps any other form of mental discipline. It is the trained scout in all fields of our national activity that we need so badly.

The other aspect from which science claims national value is from the interpretation it puts upon the functions and the historical development of the community. It teaches us to examine the efficiency of the nation from the natural history standpoint. We find that the law of the survival of the fitter is true of mankind, but that the struggle is that of the gregarious animal. A community not knit together by strong social instincts, by sympathy between man and man, and class and

class, cannot face the external contest, the competition with other nations, by peace or by war, for the raw material of production and for its food supply. This struggle of tribe with tribe, and nation with nation, may have its mournful side; but we see as a result of it the gradual progress of mankind to higher intellectual and physical efficiency. It is idle to condemm it; we can only see that it exists and recognise what we have gained by it—civilization and social sympathy. But while the statesman has to watch this external struggle, to see that the nation is really an organized whole, not a loose agglomeration of hostile groups of men seeking primarily their own profit and pleasure at the national expense; while he has to check the internal struggle of man with man, he must be very cautious that the nation is not silently rotting at its core. He must insure that the fertility of the inferior stocks is checked, and that of the superior stocks encouraged; he must regard with suspicion anything that tempts the physically and mentally fitter men and women to remain childless. He must see to it that a reserve

of brain and muscle is pushed down into occupations which have little apparent need of them, or forced into new lands—even at the expense of inferior races. For upon this reserve we shall surely have to fall back in times of crisis—and such crises will come in our lifetime, to judge by economic and political history, which may far surpass in magnitude even that of this year.* Shortly, the statesman has to hold the balance between the strong social feelings upon which are based the external success of the nation and the crude natural check to the unlimited multiplication of the unfit upon which the internal soundness of the nation depends. That is the great lesson we must learn from natural selection and the law of inheritance as applied to human communities.

I have endeavoured to place before you a few of the problems which, it seems to me, arise from a consideration of some of our recent difficulties in war and in trade. Science is not a dogma; it has no infallible popes to pronounce authoritatively what its teaching is. I can only say how it seems to one in-

* 1900.

dividual scientific worker that the doctrine of evolution applies to the history of nations. My interpretation way be wrong, but of the true method I am sure: a community of men is as subject as a community of ants or as a herd of buffaloes to the laws which rule all organic nature. We cannot escape from them; it serves no purpose to protest at what some term their cruelty and their bloodthirstiness. We can only study these laws, recognise what of gain they have brought to man, and urge the statesman and the thinker to regard and use them, as the engineer and inventor regard and then turn to human profit the equally unchangeable laws of physical nature.

The origin of the world and the purport of life are mysteries alike to the poet, the theologian, and the man of science. One who has stood somewhat as the mediator between the three admitted the mystery, saw the cruelty of natural processes when judged from the relative standpoint of man, but found therein an undefinable 'tendency towards righteousness.' If by righteousness he meant wider human sympathies, intenser social instincts, keener pity, and clearer prin-

ciples of conduct, then I believe that tendency, that continual progress of mankind, is the scarcely recognised outcome of the bitter struggle of race with race, the result of man, like all other life, being subject to the stern law of the survival of the fitter, to the victory of the physically and mentally better organized. Mankind as a whole, like the individual man, advances through pain and suffering only. The path of progress is strewn with the wreck of nations; traces are everywhere to be seen of the hecatombs of inferior races, and of victims who found not the narrow way to the greater perfection. Yet these dead peoples are, in very truth, the stepping-stones on which mankind has arisen to the higher intellectual and deeper emotional life of to-day.

APPENDIX I

NATIONAL DETERIORATION

THE future of anthropology undoubtedly lies in the application of the fundamental principles of natural selection to the problem of man. With as little doubt the method of that future will be the reconstruction of demography and anthropometry by aid of modern statistical theory. Examined from this standpoint, there is little distinction between scientific sociology and the anthropology of the future. The growth and decay of human societies is a chapter—for man, perhaps, the most important chapter—in evolutionary anthropology. When we have fully grasped the significance of the fact that man is essentially gregarious, and not single, the study of international anthropometric and vital statistics* becomes one with the study

* 'Anthropometric' and 'vital' are here used in their broadest senses, and apply not only to statistics of the relative fertility of nations and classes, of their relative physique and endurance, but also to their general capacity and intellectual power.

of natural selection in man. The lessons to be deduced from censuses, registrar-general's reports, anthropometric surveys, educational returns of every type—when these are efficiently and fully developed—become of primary national importance, and will speak imperatively in the near future to our more thoughtful statesmen.

The struggle of classes and of individuals within the community must be subservient to the general fitness of the community as a whole in its contest, in peace or war, with other communities. From this standpoint the patriotic feeling must not only be aroused by such clear and obvious sources of national deterioration as unhealthy dwellings and factories, adulterated food, drink and over-strain,* but also by those more subtle factors of degeneration which can only be appreciated by more elaborate statistical investigations. Such factors may, indeed, be far more rapid in their effects than those which are more obviously and tangibly present in the individual, and so at once attract the attention of the social reformer. The one series affect the population for the time being—there is no evidence that they will be permanently acquired by its offspring; the other series are to a much greater extent irreversible.

* The complacency which asserts that we are better than our forefathers in these respects entirely overlooks the real problem, which is centred in considering our fitness *relative* to other great nations.

For good or evil, a slender Act of Parliament could exterminate in a generation the thoroughbred racehorse in this country. How long would it take to recreate the stock without foreign importation? We do not want to depend on importation for our brains and ability,* and on this ground alone I would deprecate the tendency to pass by more subtle factors of national deterioration, because they require a little more thought than more strident evils. To emphasize this point I have republished the following letters, although they are controversial in form.

The origin of the letters must be sought for in a lecture before the Sanitary Inspectors' Association, by Sir James Crichton-Browne. In that lecture he was reported in the *Times* of August 18, 1905, as saying:

'Professor Karl Pearson, a thoughtful and cautious anthropologist, had told us that decadence of character and of intelligent leadership was to be noted alike in the British merchant, the professional man, and the workman, and this he attributed to the fact that the intellectual classes were not reproducing their numbers as they did fifty or one hundred years ago. In this view Professor Pearson was supported by the Prime Minister, who said at Cambridge last year that in the case of every man who left the labouring class and became a member of the middle or wealthier classes his progeny were likely to be diminished owing to the fact that marriages were later in that class. He was inclined to think, however, that

* A study to-day of surnames in the commercial directories of the cities of London and Manchester should give rise to reflection.

intellectual decadence, if it be upon us, was not altogether due to the causes assigned by Professor Pearson and Mr. Balfour, and was not necessarily destined to deepen as time went on. In a people like our own there was always outside the actually intellectual class a still larger class potentially intellectual with abilities incompletely evolved, because never called forth, but capable under stress of circumstances of the higher development. Many of our finest intellectuals had sprung from the unintellectual class, and genius was generally more or less of a sport. His own view was that any dearth of ability from which we might be suffering was to be ascribed not so much to the infertility of the cultivated classes as to the artificial production of stupidity in various ways, and to the incessant draining from the country—which was the fit and proper breeding-place and rearing-ground of intellect—of the best elements of our people to be swallowed up or deteriorated in our big towns. Not less untenable than the notion that the agricultural labourer was dull of intellect was the idea that the city urchin was cleverer and better endowed mentally than the little yokel. The rule seemed to be that the mental development of children was hastened by city life, but soon stopped short. Up till thirteen or fourteen years of age they were precocious, and then came to a standstill. City life at its best was bad for children, involving, as it did, early puberty, exciting distraction, superficiality of knowledge, insufficient repose, and the want of soothing influences that the country afforded ; and at its worst, when it meant a tight squeeze in squalid dwellings, poor food, foul air, contact with vice, and manifold temptations, it was utterly demoralizing. It seemed obvious that, if the city went on growing at the nineteenth-century rate, and under nineteenth-century conditions, it would dry up the reservoirs of strength in the population and leave an immense proletariat of inferior quality and without commanders.'

These words seem to me to mark a case ich a more subtle and dangerous factor

of national deterioration is placed on one side in order to emphasize the obvious, but, I believe, far less permanent effects of urban crowding on the individual, and they called forth the following letter, published in the *Times* of August 25 :

'In a recent address reported in the *Times* of Friday last, Sir J. Crichton-Browne cited a sentence from my Huxley Lecture of two years ago with regard to our present national dearth of ability. That same sentence was placed by the chairman of the Committee on Physical Deterioration before, not its author, but Professor Cunningham, and he was asked what my reasons for such an opinion might be ; he replied that he knew none whatever. Neither Professor Cunningham nor Sir James Crichton-Browne have ventured to criticise directly the detailed statistics which I have published to support my conclusion, nor, as far as I am aware, have they published any mass statistics of their own in the least confuting those advanced by me. There are several stages in the argument necessary to establish my point, and perhaps, sir, you will permit me space to restate them. They are as follows :

'I. What is the quantitative degree in which the physical characters are inherited in man? This problem was solved by the measurement of some 1,100 families—father, mother, and adult offspring. The measure-

ments took some five or six years to complete, and the results are set forth in a memoir published in 1903. They involve no physiological theory of heredity; they merely describe statistically the observed quantitative resemblance between parents and offspring, and, again, between members of the same stock. The work was an obvious, if necessary, continuation of Mr. Francis Galton's researches.

'II. Are the mental and physical characters inherited to the same extent? The answer to this question is given in the Huxley Lecture of November, 1903; and it is based on observations made on between 5,000 and 6,000 school-children. It is there shown that the degree of resemblance of members of the same stock for eight mental and moral characters and for eight physical characters in the case of pairs of brothers, pairs of sisters, and pairs of sisters and brothers is, within the errors of such an investigation, sensibly identical. For the first time we appear to have a quantitatively sound basis for asserting that there is no distinction in the degree of inheritance between the physical and the psychical. If this result be true—and so far I have seen no statistical data, only more or less dogmatic opinions, quoted against it—it must follow that the physically and mentally fitter stocks produce physically and mentally fitter offspring. Sir J. Crichton-Browne says: "Many of our

finest intellectuals have sprung from the unintellectual class, and genius is generally more or less of a sport." Now, I have personally been careful never in discussing this subject to use the word "genius." The term itself is vague, and the hard work of a nation is carried on in the main by the able and capable man, and not by vague "genius." Capacity breeds capacity, whatever "genius" may do. Now, taking the numbers actually given by our statistics, What do we find? "That pairs of exceptional parents produce exceptional sons at a rate more than ten times as great as pairs of non-exceptional parents. At the same time, eighteen times as many exceptional sons are born to non-exceptional as to exceptional parents, for the latter form only about ½ per cent. of the community" (*Phil. Trans.*, vol. cxcv., p. 47, 1900). The word exceptional here represents a very high standard indeed. But the mere fact that rare sons of commonplace parents are more frequent than the usual sons of rare parents explains the statement that many of our finest intellectuals have sprung from the unintellectual class. It does not in the least, however, destroy the importance of the fact that ability and capacity breed their like. The time ability takes to fight its way into notice renders "sports" of little service for most national purposes; the great majority of our legislators and of our leaders in art, literature, commerce, and

science are drawn from the intellectual classes. Ability, not entirely, but largely, runs in stocks; and these stocks by a long process of social evolution form in the bulk the upper social classes. Let us use every net to catch and train ability for national purposes, wherever it may be found; yet in the main able and capable men are largely the product of capable and able parents, as tall men are the product of taller stocks. If we accept the fact that mental characters are inherited, we are at once forced to ask whether the intellectual classes are maintaining their birth-rate. This is the third stage in my argument.

'III. The birth-rate of the abler and more intellectual classes in this country is falling, relatively to that of the poorer stocks. Does anyone really venture to deny this proposition? Statistics are forthcoming, and will be shortly published, to show that the families of the intellectual classes are smaller now, very sensibly smaller, than they were in the same classes fifty years ago; that the same statement is true of the abler and more capable working and artisan classes; but that as you go down in the social grade the reduction in size of families is less marked. This is true not only of Great Britain, but of the United States and of some of our colonies. That the reduction is not in the main due to the later marriage of the intellectual classes,

[illegible] Crichton-Browne suggests, would,

I think, be manifested at once if our leading gynæcologists would give frank evidence on the point.

'A diminution of national fertility may not be an unmixed evil, if it begins with the less able, or better, with the mentally and physically defective stocks in the community. But if we once realize that ability, that mental and moral characters are inherited, and that the fertility of the better and abler, the more intellectual and more socially valuable stocks in the nation, is certainly diminishing relatively to the feebler and poorer stocks, then I think we must see approaching a crisis which it will need a wide change in present social views, possibly even legislative action, to counteract. Is the dearth of ability real? Ask the men who have to appoint headmasters to schools, engineers to India, judges to dependencies, colonial governors, or civil servants at home! Nay, go further, and, putting party aside, note how few are the younger men who to-day have the power to touch the nation as a whole and lead it politically. The dearth of ability to-day must indeed depress each thoughtful Englishman; but if its sources are to be found in the two facts, first, that mental characters are inherited, and secondly, that the fertility of our abler and more intellectual stocks has been relatively diminishing during the last half of the nineteenth century, is not a remedy still possible?'

Sir J. Crichton-Browne's reply will be found in the *Times* of August 29, and led to the second letter, which follows here (*Times*, September 5):

'As Sir J. Crichton-Browne appeals from the report of his address to the full text, which I have not yet seen, it becomes impossible to base any argument on the summary provided in the *Times* of August 18. But there are several points in his reply to my letter which I think illustrate the difference between his and my attitude to problems of this kind, and which I should like to comment upon.

'All these sociological problems are really problems of mass statistics, and no appeal to mere opinion can be of any value. We can only appeal to statistical data reduced by adequate modern statistical methods. We have before us a definite problem: Is or is there not a dearth of ability at the present time in this country? If there be, what are the causes which account for it, and how can the evil be remedied? It will be noticed that I prefer to use the term ability, because all ability cannot be fairly described as "intellectual," and the term "intellectuals" is to my mind as objectionable as "genius." "Intelligence," "energy," "ability," I think I grasp; "intellectuality" and "genius" I am doubtful about; and as for the "infectivity of genius," it appears to me in the

cases cited by Sir James Crichton-Browne to amount largely to the creation of a fashion, and not to the calling into play of ability which would otherwise have remained potential. Healthy rivalry among equals is a great thing, perhaps the best thing for a leader in literature or science. But few such leaders can probably look with equanimity upon their own "intellectual infectivity"; they see their methods abused and caricatured by men of minor ability, who have drifted into wrong channels owing to the fashion of the moment. Let us use, then, the broader words, ability and capacity.

'I take it that, judged by investigation of special phases of these, we can now say that capacity and ability are inherited. Further, that Sir James Crichton-Browne agrees with me not only in this point, but also in the equality of degree between the inheritance of mental and physical characteristics in man. Now my point is this: that since the spread of modern civilization—railways schools, manufactures—say, since 1840, it has become much easier than previously for ability and capacity—I do not wish to confine our attention to intellectuality—to rise from the ranks. The upper middle-classes have been enormously increased and recruited in this way. Taking even monetary success as a crude measure of ability and capacity, we find there has been a selection, repeated for several generations, of able in-

dividuals from the lower ranks. The upper middle classes are the result of a severe selection of capacity, and, later, of intermarrying, under conditions which seem no longer possible. Think of the number of men who rose through sheer ability in the early days of railway engineering, of modern manufacture, and even of modern science, and compare their number with the output now! The Whitworth scholarships have done excellent work, the County Council scholarships fair work, in drawing out ability from the masses. But I believe each time the net is cast the harvest is less profitable. There are marked exceptions, but my own experience as a teacher is that the average County Council scholar is now intellectually, and very often physically, not up to the level of the average middle-class student; so it comes about that a good draughtsman has been turned into a poor engineer, a fair compositor into a very minor man of letters, an excellent clerk into a second-rate schoolmaster.

'I repeat again what I have said previously: throw the net as widely as you can—if its meshes are not too small—drain all the capacity and ability you can from the ranks into commission. But the middle classes form a caste into which the bulk of the abler stocks in the community have already drifted. By downward selection and by emigration of ne'er-do-well members, by intermarriage ruiting from below, the charac-

teristics of this caste have been strengthened and rendered more permanent. Sir James Crichton-Browne has misunderstood my point when he talks of the potentially intellectual class outside the upper social classes being possibly 1 per cent. of the population. No breeder who was seeking to strengthen certain characters would start from individuals in the population at large; he would start from the stocks already exhibiting traces of the characters he needed. That an exceptional individual is often born of commonplace parents does not prove the existence of potentially intellectual stocks; it merely shows the range of variation in a large population, and is no test—in defect of ancestry—that the variation will be the origin of a new stock. It is the realization of these points, that not all, but the bulk, of the abler and more capable stocks have drifted into the upper middle classes, and that ability is inherited, which makes, in my opinion, the decreasing relative fertility of these classes a matter of the most serious national importance.

'Sir James Crichton-Browne admits the dearth of ability, but he nevertheless asserts that we have "in the humbler or uneducated class, as it is called, a reserve of intellectuals of undiminished fertility, capable of supplying recruits to the intellectual class of the next generation." The only answer I can make to this is, "Statistics upon the table,

please." Otherwise this is mere opinion. It is the ladder, or what I term the net, which, according to Sir James, is defective. As far as I can see, the County Councils at present are almost carrying individuals up the ladder.

'In my letter to you, sir, I did not not say that the dearth of ability was solely due to the decreased relative fertility of the abler classes. I said that statistically this could be demonstrated as a *vera causa*, but it may not be the only one. If we know it to be at least one source—I hold a principal source —of the evil, we have recognised, at any rate, in what direction to strive for a partial remedy. Sir James Crichton-Browne in the last paragraph of his letter seems to admit my contention, although he speaks of "the ominous significance of the fall in the birth-rate," a term which from my standpoint can have no significance whatever in this matter. The problem is one of relative net fertility, and the fall or rise in the birth-rate, as calculated in the usual manner by the Registrar-General, seems to have no bearing on the subject. If Sir James admits my *vera causa*, it may be asked why am I not content to recognise his also? Or ought I to say his two causes? These appear to be:

'1. "The artificial production of stupidity in various ways."

'These ways are not closely defined, and I do not clearly know to what Sir James

Crichton-Browne is referring. I am almost inclined to think that, if we could give a measure to stupidity, we should find less of it now than a hundred years ago. Certainly, if stupidity is cured by education, there is less of it. If, on the other hand, Sir James refers to inherited stupidity, I think there may be danger of more of it, because the stupid and foolish are now very carefully looked after, have a high relative fertility, and their offspring are allowed to survive and marry in the modern struggle for existence. This point has been recently emphasized by those who have had to deal with the problem of mentally defective children.

'2. "To the incessant draining from the country, which is the fit and proper breeding-place and rearing-ground of intellect, into our big towns of the best elements of our people, to be swallowed up and exterminated or deteriorated there."

'Now it is quite possible that every word of this statement is truth; the fact that I personally can "live" in the country, only "survive" in the Metropolis, draws me sympathetically towards this view. But as a statistician I must say sorrowfully that I think every sentence in it is mere opinion. The investigations that would be needed to establish the statement are very complex and extended, and it certainly cannot be established by a simple quotation from Dr. Ogle. It is usually said that no family can

exist for three generations in London.* Has anyone made an investigation of this question, or determined in any rural district how many families have existed for three generations on one spot? This part of the problem in itself is full of pitfalls; in districts of Berkshire, say, you may find a most migratory farming class; in the Yorkshire dales the farmers have been sedentary in some cases for centuries. Is it impossible for the farming class to survive three generations in Berkshire? Nothing but a most careful statistico-genealogical inquiry would determine whether in London there was true extermination, or whether we have merely a phase of the mysterious migration problem. It is idle to show that many persons' ancestors are immigrants into London; it must be actually demonstrated that the sedentary population has a lower net fertility than in a corresponding rural district, and that this net fertility is not artificial. Then, again, "the fit and proper breeding-place and rearing-ground of intellect" is the country. How and when was this demonstrated? Having due regard to population, to the relative ability of the several components of our English nation, have more able men been (*a*) born, (*b*) reared, in country or in town? Who is in a position to answer this question?

* Communications which have reached me since this letter was published show that the statement is at least versally true.

'It has not yet, as far as I know, been dealt with from the standpoint of science. I have already asked for proof that the town population is "exterminated." Death-rates give little information; many rural denizens retire to towns to pass their old age, or, when ill, to be treated in town hospitals. Accidents are naturally more frequent in towns. And until these factors have been discriminated by modern statistical methods, and the migration problem thoroughly discussed, no answer is possible. And, lastly, as to the vexed question of deterioration, who can safely say anything on this point? The deterioration must be in the sedentary population of the towns, and the problem must not be obscured by the emigration into the towns of the wastrel population of country districts. Admit a larger proportion of degenerates in certain towns than in certain rural districts, has anyone investigated whether their stock is urban or rural? In almost every rural village in England mentally defective children will be found, not, of course, segregated as they are in the special schools of big towns. But can anyone yet tell us the proportions of rural mentally defective children, of urban mentally defective children born to sedentary parents, and of the same class born to rural immigrants largely of the wastrel type? Sir James Crichton-Browne may be correct in his second source of national deterioration, but his presentment of it bristles with

statements of which, so far, no statistical demonstration has been given. On the other hand, I think there is statistical proof of my factor that the abler stocks are now relatively less fertile, and that this, associated with the inheritance of ability, must lead to a dearth of the capable men required to officer all branches of our national activity.

'I should above all things like to see a full and careful inquiry into the action of town life on racial characters. But I do not believe that this can be done by commissions. It must be done by a statistical bureau with ample staff and equipment. The problem is a delicate, intricate, and extensive one, which may take years to solve, but its solution would be of the greatest national importance. Above all, no hasty step should be taken in asserting that our present dearth of ability is due in the main to the predominance of urban life. In nearly all medico-sociological problems at the present day we need a preliminary statistical inquiry, and this must be made on modern statistical lines. If Sir James Crichton-Browne's insistence on the evils of urban life leads to such an inquiry, it will have done great good. It may be noted that probably the first stage in such an inquiry would be the much-needed anthropometric survey of our whole school population. But I do not think the need for such an inquiry should postpone our pressing home on the English middle classes the

real seriousness from the national standpoint of their reduced relative fertility. Town life may lead to desire of ease and other pleasures than those of the family, but no nation can in the long-run survive if the abler stocks do not provide their full share of the population. In our case, probably more than in that of any other nation, is the productivity of these stocks of immense importance. There is a great wastage, and must be, of capable young men in India and elsewhere, and this wastage has to be supplied in addition to the ordinary drafts needed for home service.

'My difference with Sir James Crichton-Browne is therefore this: I do not wish to see what I hold and he admits to be a *vera causa* of our present dearth of ability placed on one side while time is spent in investigating what is possibly a contributory cause, but which at present is far from having been established as a definite factor by any adequate statistical evidence.'

These letters are not republished here because they endeavour to controvert the views of Sir J. Crichton-Browne. He and I may after all not be very far apart in our aims or opinions. But they are reprinted because they reiterate from a slightly different aspect the lesson of my Newcastle lecture—namely, that from the standpoint of science the nation has yet to learn that its relative

output of ability is quite as important as its educational facilities. When this lesson has been learnt there will be a demand for a new anthropology, and its functions will be ancillary to the higher statecraft. And if we are asked what are the first stages to be taken in dealing with these problems of national fitness, we may answer: First, the actual awakening of the nation to the consciousness that these problems of its ability, strength, and fitness are the great national problems; and secondly, in order that they may be answered wisely, we need to take anthropometric stock of where we stand and whither we are moving. The first need in this direction is the institution of a national bureau to issue decennial reports on the physical and mental condition of the population beginning with what is at once feasible, the school, pauper, criminal, and lunatic populations of the country.*

In the following two appendices abstracts are given of recent lectures touching on special points referred to in the more general lecture reprinted in this volume. It is hoped that these abstracts may indicate to the reader the type of statistical work which has

* *Cf.* the author's Prefatory Essay of 1902, 'The Function of Science in the Modern State,' 'Encyclopædia Britannica,' Supplement, vol. xxxii.

been for some time in progress. Should he desire further information, he will find material in the chapter on evolution in the author's 'Grammar of Science' (second edition, A. and C. Black, 1900), in some of the essays in the author's 'Chances of Death' (E. Arnold, 1897), but more especially in the numerous statistical memoirs which have appeared in the four published volumes of the journal *Biometrika* (Cambridge University Press, 1901-1905).

APPENDIX II

RECENT WORK IN HEREDITY

An Abstract of a Lecture delivered in November, 1904

THE lecturer regretted that the title of his discourse was somewhat deceptive, but explained that it was framed while matters were comparatively peaceful, before the controversy now raging about the subject of inheritance had begun. He stated that throughout the lecture he should avoid controversial points as far as possible, simply giving his audience an account of the work which had recently been done in his labora-

tory by his friends and himself, and of some of the conclusions to which they had been led. Nevertheless, it was only fair to remind his hearers that there was another way of looking at these matters, but that, of course, they must read or hear about for themselves. The lecturer pointed out incidentally that he and his collaborators do not depend on any biological theory such as pangenesis, but simply describe statistically the observed facts.

His remarks this evening would be based almost entirely upon measurements made upon some 1,100 families, and upon observations of some 6,000 school boys and girls.

Although his subject was rather off the beaten track of academic studies, he hoped that in time it would become part of a university course. The peculiar merit of such research is that everybody can help. There is an idea that research work in science is only possible to people who have taken a good degree. He remembered a story of a Newnham student who had not taken a brilliant degree, and was therefore told that she had better not go in for any more science, but should apply herself to 'greasing the social wheels.' Even this desirable work, however, is very difficult without the aid of science; charitable relief, medical work, and even domestic problems require a knowlede of heredity, and the best way to get this knowledge is for each person

to do some work for himself on the subject. It might sound a rather heretical remark to make within academic walls, but, as a matter of fact, a period of life comes to nearly every student when he burns his text-books and begins to think for himself, and realizes that the diagrammatic life of the lecture-room is not the real world of nature. With a scientific conscience—in other words, a great capacity for taking pains and a determination to be absolutely truthful—sociological research is one in which everyone can take part.

The great general problem of heredity is this: *Given the ancestry, what are the offspring likely to be?*

Now, the characters of the offspring depend on those of the parents; and if we knew the parents *completely*, we should know the offspring, but in reality only a few factors are knowable in the parent, and it is to the remoter ancestors that we must go in search of conditions which will explain the germinal characters of the parents. The lecturer reminded his audience that he and his collaborators had been contemptuously called 'ancestrians.' They welcomed the name with pride, further asserting that they are not only ancestrians, but collateralists as well, for if one wants to study one's own germinal capacity one must examine not only one's ancestors, but one's aunts, uncles, and cousins.

Now, the first thing to do in comparing one individual with another is to find a way of measuring their resemblance. At present it is not possible to measure general resemblance; Mr. Francis Galton thinks such a method may be possible in the future, and it is to be hoped that he will succeed in time in elaborating one; meanwhile we must be content to compare single characteristics, such as pigmentation, size and shape of individual organs, or even intellectual characters.

He would first call the attention of his audience to a table drawn up from imagination, to show what would happen if there were no such thing as inheritance. It is found, say, that among cattle, in every ten about two are parti-coloured, three red, four roan, and one white. Now, if there were no such thing as inheritance each sire would produce offspring of which two in every ten would be parti-coloured, three red, four roan, and one white—that is, his offspring would resemble not himself, but the general population, in pigmentation. Now, it is found actually that no such thing occurs; parti-coloured sires mated in the actual proportions with the females of the community will produce offspring of whom the majority will be parti-coloured, and so on, and, if it be put in the form of a table in which the offspring of each kind of sire are in a vertical line, we may have results like this:

SIRES.

		Parti-coloured.	*Red.*	*Roan.*	*White.*
OFFSPRING	Parti-coloured -	48	12	16	4
	Red - - - -	12	78	24	6
	Roan - - -	16	24	112	8
	White - - -	4	6	8	22

It will be observed that the greatest numbers come diagonally across the table ; hence this diagonal arrangement must be in some manner a measure of the degree of resemblance between sire and offspring.

The lecturer further showed by means of a model that in comparing stature of fathers and sons, the same weighting of the diagonal is obtained. Thus, where the stature of the father is above the average, so is that of the son, though not by as much.

That this inheritance of the father's characteristics is a general rule may further be seen by comparing the cubits of father and son—*i.e.*, the measurement from tip of finger to elbow. Here it is found that fathers with long cubits pull their sons cubits up above the average length by about half of the difference in cubit between the father and the average; while short fathers pull their sons below the average by the same amount.

In this way ·5 may be taken as a measure of the degree of resemblance between a child and one parent. Since exceptional mothers are found to exert the same influence of about

half upon their offspring, it is to be expected that the sum of the father's and mother's influence would equal unity. If exceptional parents married at random this would be the case, but in practice it is not so, for since there is a tendency for like to mate with like, some of the characters undergo reduction. A convenient formula for expressing the actual extent of inheritance is the following:

Length of son's stature
$= 14'' + \frac{41}{100}$ of father's stature $+ \frac{43}{100}$ of mother's stature.

Length of daughter's stature
$= 11'' + \frac{39}{100}$ of father's stature $+ \frac{43}{100}$ of mother's stature.

(This is, of course, not absolute for individuals, but holds only for averages.) Thus, two parents who have an exceptional stature give their offspring 80 to 83 per cent. of their stature.

Exceptional grand-parents bring this up to 95%.
„ great-grand-parents bring this up to 97%.

The offspring of the individual who has thus been pulled up, provided his mate is up to the like standard, do not regress. In other words, a stock may be formed in two generations, and, once formed, the responsibility of maintaining the stock afterwards lies with the individual. Here, then, begins legitimate pride in ancestry. Similar relations were shown to hold between mother

and daughter, and between father and daughter, and the same principle is found true for many other characters.

If other pairs of relatives be considered, a similar 'correlation' is observed. Thus, from knowing the length of the forearm of the brother the probable forearm of the sister can be predicted, while, on comparing the cephalic indices of a large number of pairs of brothers and plotting them against each other, the means of the fraternities of brothers with given head-shape were shown to lie almost upon a straight line. It is found, moreover, that brothers and sisters are rather more like each other than like their parents.

Similar principles may be applied to the classification of individuals according to mental qualities. Teachers were found to agree to within 85 per cent. in their classification of children according to intelligence. If their classification of a large number of children into 'very dull,' 'slow dull,' 'slow,' 'intelligent,' and 'quick intelligent' be adopted, it is found that the average child is on the border-line between 'slow' and 'intelligent.' If, now, pairs of sisters be classified, it is generally found that the 'slow dull's' sister will fall somewhere between 'slow dull' and 'slow intelligent,' while the sister of the 'quick intelligent' will probably be merely 'intelligent.' Thus, again, the exceptional individual indicates an average relative above

the average of the general population, but does not connote a relative as far away from the average as himself. A like relationship is seen in comparing sisters with brothers.

If these principles be further extended to intellectual and moral qualities, such as vivacity, assertiveness, introspection, popularity, probity, temper, intelligence, and even handwriting, a quality which has probably much to do with temper and conscientiousness, similar laws are found to hold good.

Now, if we further compare the figures obtained for degrees of physical resemblance with those for degrees of psychical resemblance, it is impossible to avoid the conclusion that they are inherited at about the same rate. This was illustrated by plotted curves, which were shown practically to coincide.

The question now arises: *Do the same laws hold among animals?* There is no doubt that they do, as the following example, one of many, will show:

Resemblance between Sire and Male Offspring.

·49 = eye-colour in man.
·52 = coat „ „ horse.
·53 = „ „ „ basset-hound.
·53 = „ „ „ greyhound.
·52 = mean.

It will be observed that the figures approximate closely.

When it becomes a question of the lower

organisms, such as snails, moths, water-fleas, etc., we are met by the difficulty that few figures on the subject are at present available. This is, indeed, a field in which far more research is required. But as far as we may venture an opinion at present, it seems likely that the same law of inheritance holds for mass-communities in all forms of life.

It is found that the degree of resemblances of grand-parents is about two-thirds that of parents.

Hence the inheritance from a grand-parent

$$= \tfrac{1}{2} \times \tfrac{2}{3} = \cdot 33.$$

While the inheritance from a great-grand-parent;

$$= \cdot 33 \times \tfrac{2}{3} = \cdot 22.$$

Thus the intensity of inheritance appears to decrease in geometrical progression as we go backward.

Now, to summarize, though no physiological theory has been formulated, it is possible to arrive by pure statistics at the degree of inheritance, and hence to predict fairly accurately what the average offspring of any pair will be like; and this is what the social reformer, the medical man, and even the politician, really want to know when dealing with the people in large masses.

The newer biological theories appear in their latest form to invert our process; they require a knowledge of the offspring and

often of the offspring's offspring before they can predict the characters of the parents.

From our standpoint we are forced to realize that in judging of social conduct—*e.g.*—of the suitability of persons for charity, etc., we should be particular in inquiring concerning ancestry. Pity and help the weak, but remember that it is a national evil when any charitable or social institution allows the indefinite multiplication of the unfit in mind or body.

In all social work and in all legislative action true progress is impossible if the reformer and the legislator do not know and pay attention to the principles of heredity.

Major L. Darwin moved a vote of thanks to Professor Pearson, and said his own interest in the subject was inherited; and he gave an emphatic warning against the evils which may, without care, result from the present movement for educating defective children. The danger was lest their education, by making their departure from the ordinary standard less obvious, should make it possible for them to marry and hand on their defects of mind and body to their descendants.

APPENDIX III

THE BEARING OF OUR PRESENT KNOWLEDGE OF HEREDITY UPON CONDUCT

An Abstract of a Lecture delivered in May, 1904

In any general discussion on matters of conduct our first questions must be, What do we understand by 'morality'? and Why do we act 'morally'?

At the basis of our nature there are two general principles:

1. The instinct of self.
2. The instinct of the 'herd.'

In certain types of life the gregarious tendency is small; in man it is, perhaps, more dominant than any other instinct. The individual struggle is subordinated to the struggle between group and group, and the whole progress of mankind is largely due to the survival of those groups which are the most completely 'socialized.'

Now while nobody denies the instinct of self-preservation, some may deny the instinct of the herd, yet as a slight proof of its innate existence we admit that the bulk of us feel shame at national disaster and a thrill

at the heroism of men of our own race ; that we have a pride in the success and a firm belief in the future of our nation. We have, in short, an instinct which impels us to work for the preservation and the development of the society of which we are members. This instinct is precisely like that which, in other types of life, guides the conduct of the herd in uniting for common defence. The tendency to social conduct is a product of evolution resulting from the survival of the group in which this instinct was most strongly developed and most rationally guided. All of us probably pass through a period of metaphysical measles, but having done so, we drop the categorical imperative and face the historical evolution of morality. If we trace that evolution from the folk-lore and custom of the most barbarous groups up to the highest stages of civilization, we recognise no permanent code of moral action apart from our social relations. Moral conduct is social conduct, and immoral conduct anti-social conduct. And what is social and what is anti-social depends upon the condition of the society with which we are dealing. From this aspect legal institutions, industrial systems, and religious customs, which are moral to one state of society, may be immoral to another state of society, or, indeed, to the same society at a different period.

By moral conduct, then, we mean that

which tends to the welfare and progress of the group of which we are members, and by immoral conduct the reverse. The gratification of instinct, in this case the instinct to 'social' conduct, is the 'reason' for social conduct. There is a correlation between happiness and the fulfilment of instinct, and the source of the instinct is the continual selection for survival of those groups with more social instinct in the struggle of group against group.

Now if we admit this view, two divisions of our topic for to-day at once confront us :

1. What is our present knowledge with regard to heredity in man?

2. How does this bear upon conduct—on the action of individuals in relation to the welfare of society as a whole?

With regard to the first division, we find from observation a perfectly definite inheritance of physical characters.

[The lecturer here illustrated by tables and diagrams the inheritance of characters from father to son; the average son inherits ·4 to ·5 of the deviation from mediocrity of the father.]

The same inheritance can be traced in all human characters upon which investigations have hitherto been made. So universal, indeed, is this principle of inheritance, that if the main characteristics of a number of parents are given we can safely predict the

constitution of their average offspring. Nor is this inheritance confined to man alone, for we find almost the same hereditary intensity in other forms of life, from dog to water-flea. Fraternal relationships are equally strong. Thus, if we consider the cephalic index, the ratio of breadth to length of skull, we find the slope of the 'regression line' in the case of parental relationships to be ·4 to ·5, while in the case of fraternal it is ·5 to ·6.

Now progress does not depend solely on physique, but also on 'psychique.' But if we turn to the consideration of the inheritance of psychical characters, we see the same results.

The line which represents the resemblance of brothers in ability has a slope which again approximates to the mean ·5, and a like result is also shown in plotting the inheritance of shyness or temper.

Fraternal resemblances have the same intensity for physical and psychical characters. From wide observations, then, we are led to this general statement: Inheritance in masses of men is the same as in other forms of life, and this inheritance covers both physical and psychical characters. We do not know what is the best type of man for the society of the future, but we do know that no society can exist in which health, sanity, and intellectual ability are not fully represented. We know also that health, sanity, conscientiousness and ability are inherited characters. If you breed

largely from the unhealthy, the mentally defective, the stupid and unconscientious members of a society, your society will degenerate, and that more rapidly than is generally recognised. Thus 25 per cent. of married couples produce 50 per cent. of the next generation. In other words, owing to difference in the size of families, probably about one-sixth of the adult men and women in the community produce more than half the next generation. If that one-sixth chances to be the less thrifty, less conscientious, less sane and less able portion of the community, a very few generations will suffice to totally change the character of a nation. The inexplicable decline and fall of nations following from no apparent external cause receives instant light from the relative fertility of the fitter and unfitter elements combined with what we now know of the laws of inheritance.

The one safeguard against this multiplication of the unfit lies in a selective death-rate. And man as much as any other form of life is subject to natural selection.

[This was illustrated by diagrams of the 'Inheritance of Duration of Life,' and of the relation between 'Number of Offspring and Length of Life'; also by tables giving determinations of the selective death-rate in man.]

The effects of natural selection are in man, however, interfered with by other causes, the chief of which is the relative fertility of class.

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We have, then, two opposing factors—natural selection and selection of the most fertile, who may be the most unfit. Both these processes can be largely controlled by human institutions, and it is one of the gravest problems of both individual and communal conduct to realize to what extent our actions will tend to check or foster these two tendencies.

Next let us turn to the second division of the subject: how do these laws of inheritance of fertility and of selection apply to the present state of affairs?

If we consider the general birth-rate of this country, we find that since 1877 it has been steadily declining. Some of this decline is due to lessened infant mortality and increasing longevity, but a part of it to actually decreased fertility.

We might hope, however, that if fewer beings come into the world, they are, at least, born of the healthier, saner, and thriftier classes. The very reverse is the case. The birth-rate of the better type of working man has been falling off more rapidly than the birth-rate of the nation as a whole. [Illustrated by diagrams.]

Let us compare this state of things with the increase of lunacy in the population at large. Lunacy is one of the things which we may quite definitely accept as an inherited character. The stock in the community in

which it is prevalent has been freely reproducing itself. If we try to attribute the increase to the 'thranged' state of modern life, we have only to consider the rapid increase of imbecile *children.* [Diagram.]

The percentage of the mentally defective among the pauper population is also increasing rapidly. This spread of the degenerate is not due to harder modern conditions of life, for these conditions are substantially better than they were 50 or 100 years ago. It is due to two facts :

1. That the action of natural selection has been largely suspended; the physically and mentally unfit are now tended and provided for in a manner quite unknown 100 years ago.

2. The relative fertility of the fit and unfit in the community has changed widely since 1877. A hundred years ago you hung a rogue if you caught him. Nowadays you provide him with soup-kitchens and night-shelters up and down the country, and leave him to propagate his kind at will.

To cite an often-quoted German case: One woman, a thief, a drunkard, and a tramp, had 709 traceable descendants; of these 106 were illegitimate, 142 tramps and beggars, and 64 lived on charity; 181 of her female descendants were women of ill-fame. Of the total tribe 7 were murderers and 76 convicts; and altogether, in 75 years in trials, almshouses, and prisons, the tribe cost a

quarter of a million in money to the State. It would have been better for society if this woman had been at once removed from it. Criminality is as much inherited as any other psychical character, and to allow it scope to reproduce itself is more anti-social than the old custom of giving it short shrift.

I do not think that there can be the least doubt that with the great extension of charities—whether for food or for medical assistance—we have tended more and more to check the action of natural selection within the community.

But the lessened restraint on the fertility of the unfit would be of small effect if it had not been accompanied by the relatively more restrained fertility of the fit.

The unthrifty increase and multiply, and make the struggle harder for the thrifty, the conscientious, and the able, who have to provide not only for their own offspring, but for the offspring of the unfit in the next generation.

I would therefore emphasize the view that much of the current feeling with regard to early marriage and good-sized families is demonstrably immoral, and is opposed to social welfare in that it must lead to the degeneration of the society in which it is current.

Our present knowledge of heredity shows us that the average man is a product of his ancestors in health, in intellect, and in honesty.

Hence all social conduct should be directed, on this point to insuring that the minority, who in any case provide the next generation, is formed from the best stock in the community. The fertility of the unhealthy, of the mentally defective, of the dishonest, should be checked by custom and legislation in every way; while that of the healthy, sane, and conscientious should, on the other hand, be in every way encouraged.

If we consider first individual conduct, we see need for a revision of current social feeling with regard to ancestral history. Both man and woman ought to know the tale of their past; the faults, physical and mental, of ancestors and other relations ought not to be hidden away; and the need of a new and rational pride in ancestry should be inculcated.

The celibacy of the individual who comes of faulty stock should be recognised in social conduct, and social condemnation should follow marriage into a tainted stock or the marriage of any members of such stock. But such restraint of bad stock must also be accompanied among the educated by a change of feeling as to the conduct of the healthy, able, and generally fit stock.

We require, indeed, what it may be difficult to create—a strong social feeling against that celibacy which flows from the desire for the increased powers of enjoyment resulting when no hostages have been given to fortune.

A reconsideration of current feeling in the educated classes may achieve something; it might even modify the disastrous drop in fertility to which I have just referred. But it cannot achieve everything. Even if we succeeded in convincing the better type of artisan of the anti-social character of his present conduct, we have also to meet the fact that the fertility of the unthrifty, of the mentally defective, and of the criminal classes, cannot be influenced in this way, and it is relatively larger than that of the better stock.

Now, I do not advocate any return to the hanging of rogues, nor would I propose to cease medically assisting the physically and mentally unfit; but I would, both by social opinion and by legislative action, limit in every way their multiplication. Society is bound to provide for the criminal, the tramp, the congenital pauper, and the imbecile born in its midst, yet, while undertaking this duty, it should insure that, so far from increasing in numbers, their stock should diminish. It is easy to see a variety of ways in which some effect could be given to this idea.

I do not believe that the closing of all the casual wards in the country would be unjust to a single human being who is of any value to the nation at large. Again, we have the undesirable alien admitted because he keeps wages down. He comes with a poor physique and a low standard of life, and is often merely

a German or a Russian rogue. Should he not, on his introduction, be asked to show some credentials of his usefulness to our body social? Should he not be repatriated whenever he has been convicted of crime in this country and has served his sentence?

Next we have our own criminal classes. Why should the habitual criminal be allowed back into the community to propagate his kind in the intervals between his prison periods? We ought to expatriate all confirmed criminals (our Empire is wide enough to provide a corner for them); for the one thing which does seem to upset the predictions we can base on the laws of inheritance is the influence of a complete change of environment on the constitutional characters. Let us send our criminals to a subtropical climate.

Lastly, we come to the congenital pauper and the insane. Here I think again society would be justified in refusing to allow them to pass in and out of workhouses and asylums. The cure of the insane is idle in the sense that their offspring will no longer be of tainted stock.

All these points are only illustrations of what a strong public opinion might achieve. Once recognise that physical and psychical characters are inherited, and current social feeling on the subject of the unhealthy, the mentally defective and criminal stocks must

be immensely modified. The stability of the nation depends essentially on the fitter stock being given sensibly greater fertility than the unfit stock.

As things stand at present, neglecting the laws of inheritance, we are slipping down an incline with increasing speed. A sense of responsibility and of desire for comfort and leisure is leading to an ever diminishing birth-rate of the folk with *mens sana in corpore sano*, and we have, on the other hand, provided unlimited medical comforts and housing for the physically unfit and for the rogue. Whether knowledge of what is going on can possibly bring about a change of feeling I cannot say. If it does not, and we leave the fertile, but unfit, one-sixth to reproduce one-half the next generation, our nation will soon cease to be a world power.

The problem is simple in the extreme. We have two groups in the community—one parasitic to the other. The latter thinks of to-morrow and is childless, the former takes no thought and multiplies. It can only end as the case so often ends—the parasite will kill its host, and so end the tale for both alike.

THE END

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